PROJECT STATEMENT OF WORK
K1 WATER DISINFECTION GENERATOR

UNIVERSITY OF NEW MEXICO
SCHOOL OF ENGINEERING

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AQUA RESEARCH

UNM SCHOOL of ENGINEERING

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1. EXECUTIVE SUMMARY

Aqua Research, LLC develops innovative water treatment technologies that meet the extreme needs within developing countries and provides sustainable water purification to outdoor enthusiasts, travelers, emergency preppers, first responders, Peace Corps, and the military. Aqua Research also provides consulting services for innovative state-of-the-art technologies. Aqua Research's expertise primarily resides in electrolytic technologies that produce disinfectants from common table salt to a variety of water filtration technologies. Aqua Research sets out to create the world's best personal water purifier – the smallest, easiest, and most cost-effective water treatment solution for developing countries. Students working on this project will help to see this goal through to fruition by designing a prototype of a K1 water disinfection generator.

2. BUSINESS NEED

Chlorine is the gold standard for disinfection for drinking water, health care facilities, low income settings, disasters, industrial applications, and many others. Chlorine can be made cheaply and effectively using electrolysis of a saltwater brine solution with common table salt and power being the only consumables. This technology represents a huge world-wide market potential. Control systems to be designed must be effective at controlling the concentration of chlorine generated in the process, the systems must be capable of recovering from power disruptions, and the systems must identify and communicate alarm conditions.

3. PRODUCT SCOPE DESCRIPTION

The design team will work closely with Aqua Research's technical lead to:

- expand on an earlier circuit board design and software program
    - analyze previous board used – BeagleBone Black (see Figure 1)

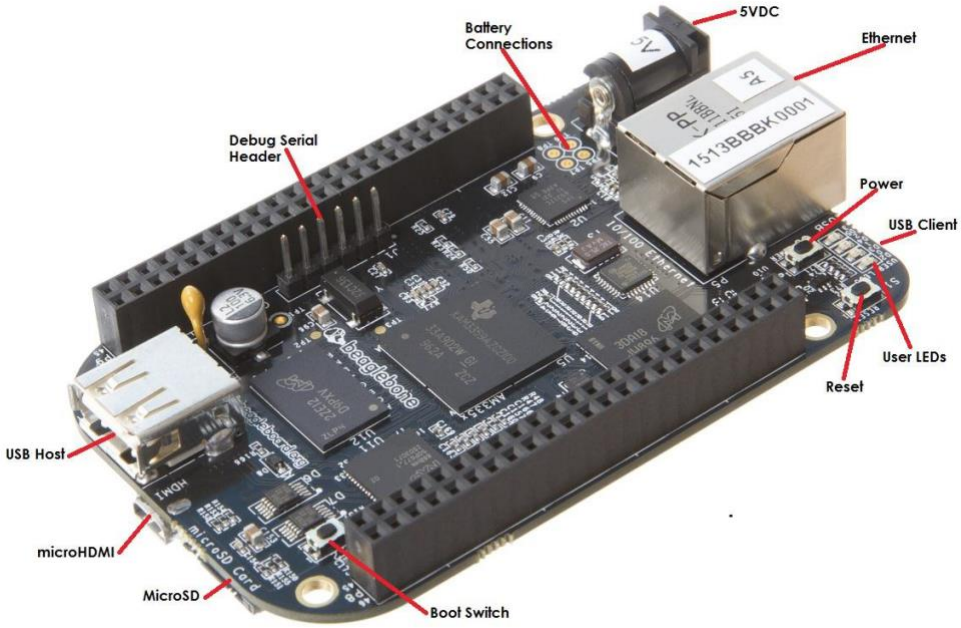

Figure 1: BeagleBone Black

- compare block diagrams of newer boards to determine if better options are available (see Figure 2)

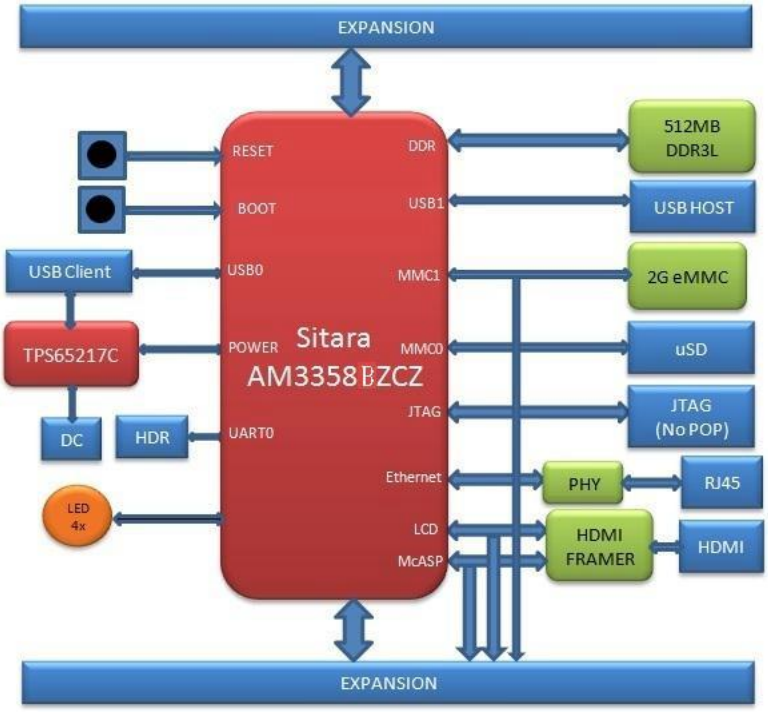

Figure 2: High Level Block Diagram of BeagleBone Black

- build a production control board
  - Aqua Research would like to incorporate titanium sensors that will monitor saltwater brine levels as well as clean water.
- upgrade and enhance the software for communications, alarms, and diagnostics
  - For Aqua Research, detecting problems in remote areas and notifying end users is critical. This would ideally be done via a mobile phone application.
- and build a prototype operational system
  - The board chosen will ultimately determine which programming language used. Ideally, a hardware design language such as VHDL or Verilog would be used to create fast, low-power operation.

There are no working prototypes for comparison, so the only quantitative deliverable that we could improve upon is designing a board that is faster, uses less power, and has smaller form factor than the BeagleBone Black. This could be done using a Raspberry Pi Zero W (see Figure 3), which also features wireless and Bluetooth Low Energy (BLE). All of these considerations will need to be addressed in the product design.

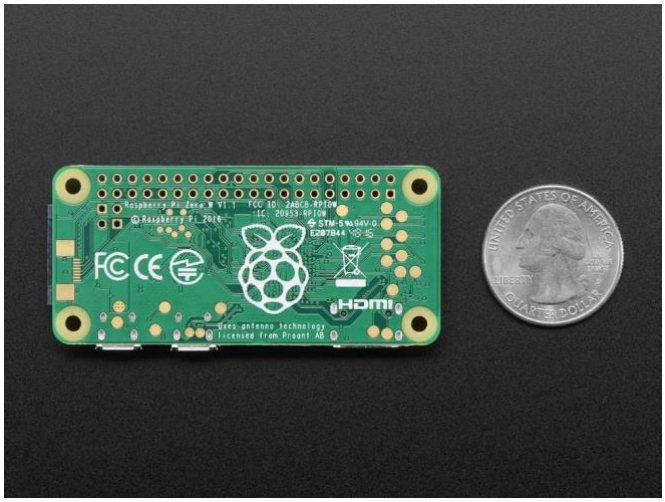

Figure 3: Raspberry Pi Zero W

4. PROJECT SCOPE DESCRIPTION

To make this project successful, the students will need to analyze the previous design, create an action plan, and collaborate with the sponsor in order to satisfy the organization's desired outcomes. This will be done by breaking the project into five phases: project planning, research and development, design production, testing and optimization, and, finally, creating an operational prototype.

PROJECT SCHEDULE			
Task	**Duration (Weeks)**	**Start**	**End**
PHASE I: Project Planning	**2**	**12-Oct 2019**	**31-Oct 2019**
Statement of Work			31-Oct 2019
Gantt Chart			31-Oct 2019
Manpower Cost Estimates			31-Oct 2019
Preliminary Requirements			31-Oct 2019
Functional Specs			31-Oct 2019
Test Plans			31-Oct 2019
P&ID Criteria			
PHASE II: Research & Development	**6**	**31-Oct 2019**	**12-Dec 2019**
Research Previous Hardware			
Block Diagram			
Analyze Design Code			

Analyze Current Capabilities			
Determine Future Capabilities			
Ethics Report			05-Dec 2019
Revisions to Functional Specs			28-Jan 2020
PHASE III: Design Production	**12**	**12-Dec 2019**	**01-Mar 2020**
Develop Software			
Integrate Controls			
PHASE IV: Testing & Optimization	**8**	**01-Mar 2020**	**20-Apr 2020**
Test for Unexpected Behavior			
PHASE V: Operational Prototype	**16**	**01-Mar 2020**	**07-May 2020**
Characterization Report			23-Apr 2020
Exit Knowledge Probe			05-May 2020
Project Notebooks			07-May 2020
Final Design Report			07-May 2020
Posters			07-May 2020
Senior Design Expo			12-May 2020

5. SPONSOR SUPPORT ELEMENTS

SPONSOR SUPPORT ELEMENTS		
Element	**First Needed**	**Needed Until**
Sponsor's Technical Advisor, at least 1 hr/wk	12-Oct 2019	12-May 2020
Sponsor's Internal Research Reports on K1 Prototype	12-Oct 2019	12-May 2020
Authorization/Funding to Order Components	12-Oct 2019	12-May 2020
Assistance with Fabrication of Boards (if necessary)	TBD	

6. APPROVALS

The signatures of the people below indicate an understanding in the purpose and content of this document by those signing it. By signing this document, you indicate that you approve of the proposed project outlined in this Statement of Work and that the next steps may be taken to create a Requirements Document and proceed with the project.

Approver Name	Title	Signature	Date
Rodney Herrington	Sponsor		
Tim Cushman	Technical Mentor		
David Kirby	Project Manager		
Diego Chavez	Project Manager		
Romero Jordan	Instructor		